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ABSTRACT

Past research has indicated training in judgment and production produce contradictory results; the former increases quality and decreases productivity while the latter decreases quality and increases productivity. Four treatment conditions (no-training control, judgment training, production training, and combined training) demonstrated that the training procedures can be combined to increase judgment ability, solution quality, and productivity over separate training. Increased judgment ability enables the subjects to (a) select the information which will give the best solutions in the end, and (b) identify superior solutions once completed. Educational training procedures for productive thinking should include criteria for solution evaluation for maximum transfer. (Author)

Improving Productive Thinking by Training in

Production and Judgment

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1. Objectives of the Inquiry

This study experimentally compared two training methods for improving productive thinking.

Previous attempts to improve productive thinking have yielded conflicting results. One type of training focuses on increased ideational fluency and flexibility (production training) and results in more solutions and more good solutions than no training (e.g., Davis, Manske, and Train, 1967).

Contradictory results are obtained from training which focuses on increasing one's ability to evaluate solutions (judgment training). This type of training results in decreased productivity but increased average quality and a greater percentage of good solutions than no training (Johnson, Parrott, and Stratton, 1968; Stratton, Parrott and Johnson, 1970). More importantly after judgment training problem solvers can select those avenues of thought or solutions which should be developed and have the best chance of being successful in the end. This is especially important when many different solutions are possible but only one solution is required from each problem solver.

The present study investigated the separate and combined effects of these seemingly incompatible types of training.

2. Methods

Four treatment groups of 45 subjects (Ss) each were composed by randomly assigning introductory psychology volunteers. For each group the experimental session consisted of the pretraining tests, training or filler activity, and posttraining tests in that order. The pretraining tests involved (a) writing titles for the plot of a novel or movie for seven minutes and then (b) taking a multiple-choice judgment test composed of possible titles for that plot. The posttraining tests involved (a) writing titles for a different plot. Time was unlimited to detect motivational differences between groups. Ss recorded elapsed time until three minutes had elapsed during which no additional titles were recorded. Then, (b) Ss began the multiple-choice judgment test. This procedure was identical for all Ss, and instructions for both problems requested "clever" and "appropriate" titles. Only types of training differentiated the groups.

The control (C) Ss worked on neutral filler materials while other Ss were trained.

Production training (PT) Ss spent 20 minutes practicing the morphological synthesis method of problem solving, which involved recording and arranging every detail of the problem under major and minor divisions of importance (i.e., a factorial arrangement). Thus, Ss could use the resultant "idea table" to generate all possible combinations of ideas and as a springboard for their intuition and imagination. Past research on less complex problems (e.g., Davis, et al., 1967) and our pilot work has demonstrated the effectiveness of this training method.

Judgment training (JT) Ss spent 20 minutes inspecting examples of good and bad plot titles, practicing with the judges' criteria for plot title evaluation,

and stating their own criteria for good titles. This is the same training program which was successfully used by Johnson, et al. (1968).

Combined training (CT) Ss spent 20 minutes working on each training booklet. One-half of the Ss in this group received the JT booklet first and one-half received the PT booklet first. Since there were no differences between these presentation orders on any dependent variable, the data were combined for all further comparisons.

3. Data Sources

Each plot title was coded and typed on a 3x5 card. Plot titles were randomly presented to two judges who independently rated the cleverness and appropriateness on a 1 (bad) to 7 (good) scale (inter-judge agreement = .85 - .87). Each S received a score for six dependent variables (see Table 1) on each problem. The performance change between the first and second problem was determined by a difference score. A positive difference score indicates a higher score on the second problem. The difference score data will be discussed as three general types of performance. Judgment ability is the number correct on the multiple-choice judgment tests which followed each plot title problem. Quality is the mean quality and the number of superior plot titles (above the 90th percentile in quality for all obtained plot titles). Productivity is the number of plot titles, time spent of the problem, and the number of titles per minute.

Table 1
Mean Difference Scores for Six
Dependent Variables

GROUP	JUDGMENT ABILITY	QUALITY		PRODUCTIVITY		
	Number Correct	Mean Quality	Number Superior	Number of Solutions	Time	Solutions Per Minute
Control	-.31 ^a	.15 ^a	-.42 ^a	5.73 ^a	1.62	.37
Production Training	.04 ^a	.21 ^a	.87 ^b	22.11	6.96	.84
Judgment Training	1.07 ^b	.77 ^b	.44 ^{ab}	2.62 ^a	3.07	-.19
Combined Training	.67 ^b	.87 ^b	1.33 ^b	9.31	5.36	.09
F(df = 3/176)	4.65*	6.03*	5.31*	4.84*	20.56*	24.68*

Note. Entries with the same letter do not differ at the .05 level by Newman-Keuls tests.

* $p < .01$

4. Results and Conclusions

Production training did not increase judgment ability above that of condition C. (Table 1). This indicated that Ss in both PT and C would be naive if they had to identify their own best plot titles. PT did produce greater productivity, many superior plot titles, and an inferior mean quality.

Insert Table 1 about here.

Judgment training increased the judgment ability and mean quality above C and PT, but JT produced a lower level of productivity.

Combined training represents the best of both training methods. CT produced better performance on all variables than C. Productivity was increased over JT alone, and quality was increased over PT alone. But CT has the added advantage over PT of increased judgment ability. CT Ss can not only evaluate solutions after they have been completed, but also they can search through the "idea table" to select the most profitable approaches to the problem and the best information for new plot titles.

The CT, JT and PT Ss produced many superior plot titles, but increased production of superior titles can be the consequence of increased productivity as well as increased judgment ability (Johnson, Parrott and Stratton, 1967). Taking the percentage of titles which were superior cancels out the effect of quantity leaving only the effect of judgment ability. The C (7%) and PT (4%) Ss produced a lower percentage of superior titles than CT (14%) and JT (17%) Ss. Thus, PT Ss generated superior titles by virtue of their fluency and JT and CT Ss by virtue of their selectivity.

5. Scientific and Educational Implications

Heretofore researchers in problem solving have regarded training in judgment and production to be contradictory; one increasing productivity and one decreasing productivity. The present study shows that both training procedures can be combined to produce significant advantages over separate training procedures. This would be predicted by a theoretical model of problem solving which regards production and judgment as separate processes.

Studies of productive thinking training generally assume that problem solvers possess sufficient background information to write plot titles, think of situational consequences, etc.. The present investigation, however, stresses the importance of another type of background information, the criteria for solution evaluation. It is not enough to be able to produce many ideas which someone else must evaluate. One must be able to evaluate one's own ideas accurately to prevent wasted effort from exploring undesirable directions of thought, and one must be able to submit the best ideas for further elaboration and final evaluation by an external critic.

The specific implication for education is that programs for training productive thinking must either demonstrate transfer to classroom performance or incorporate into the training the criteria for solution evaluation used in various disciplines. An alternative which may maximize transfer to classroom performance would be to incorporate the training into regular classroom activities, so that problem solving with the class content is an everyday activity.

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